

ISOL@MYRRHA

an exotic island in Mol

Paul Schuurmans
for the MYRRHA team

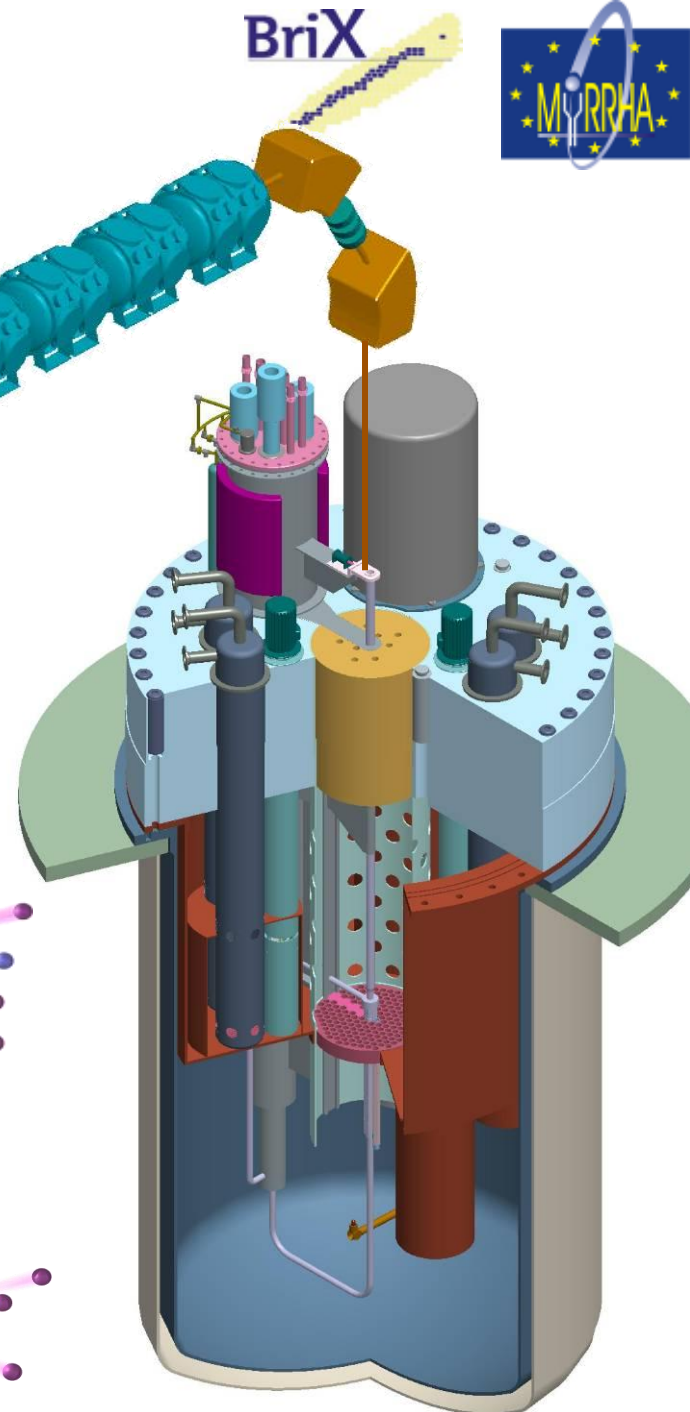
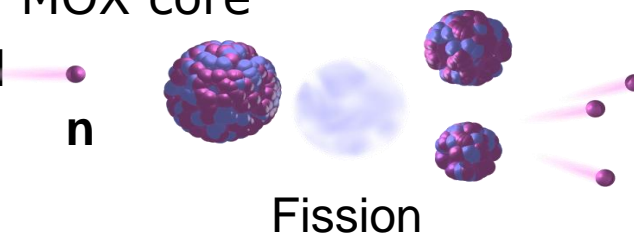
- LINAC Accelerator
 - High reliability
 - Power :
 - $I=4\text{mA}$, $E=600\text{ MeV}$

- Spallation target

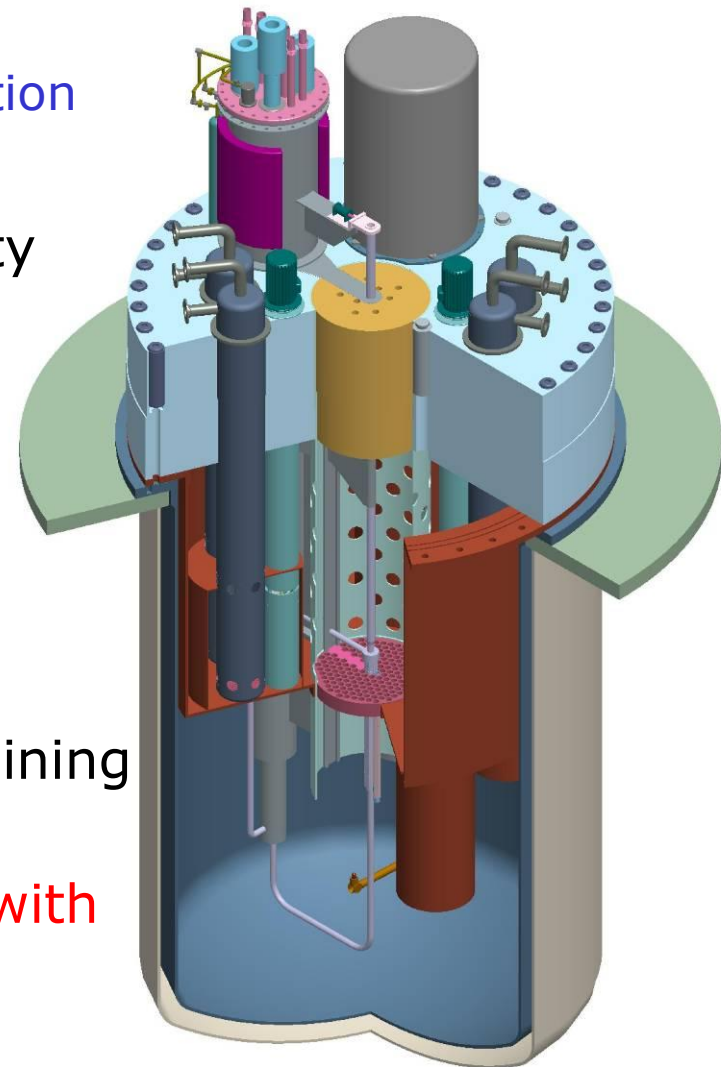


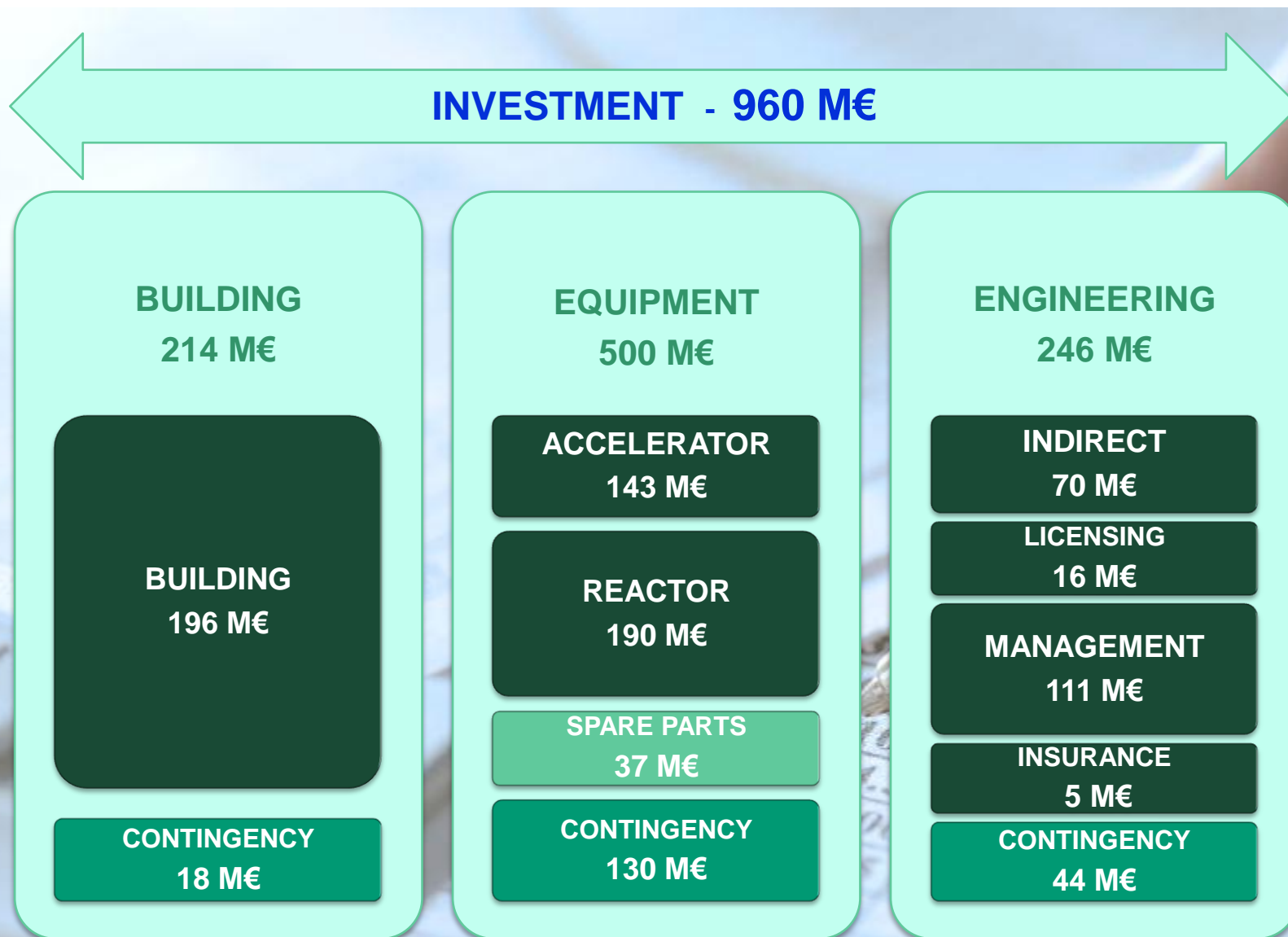
- Reactor

- High power density MOX core
- Liquid metal cooled
- High flexibility

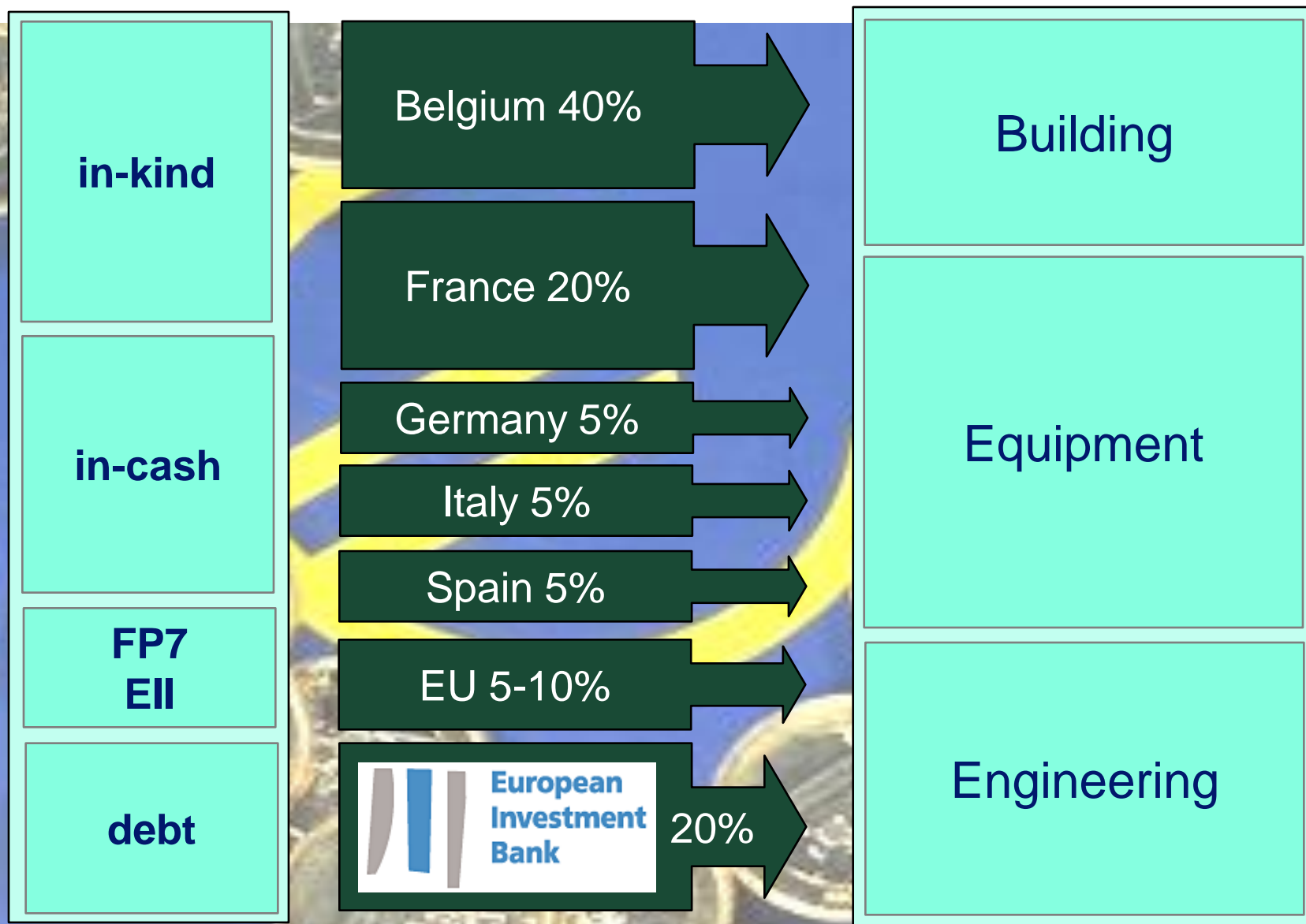


- ADS demo facility at power (50-100 MW)
 - Double strata Partitioning & Transmutation
- Flexible fast spectrum irradiation facility
 - Need for high performance core :
high power density in limited volume
 - ✓ Gen IV
 - ✓ Fusion
 - ✓ Medical isotopes
- an attractive tool for education and training of young scientists and engineers
- Fundamental nuclear research facility with the accelerator



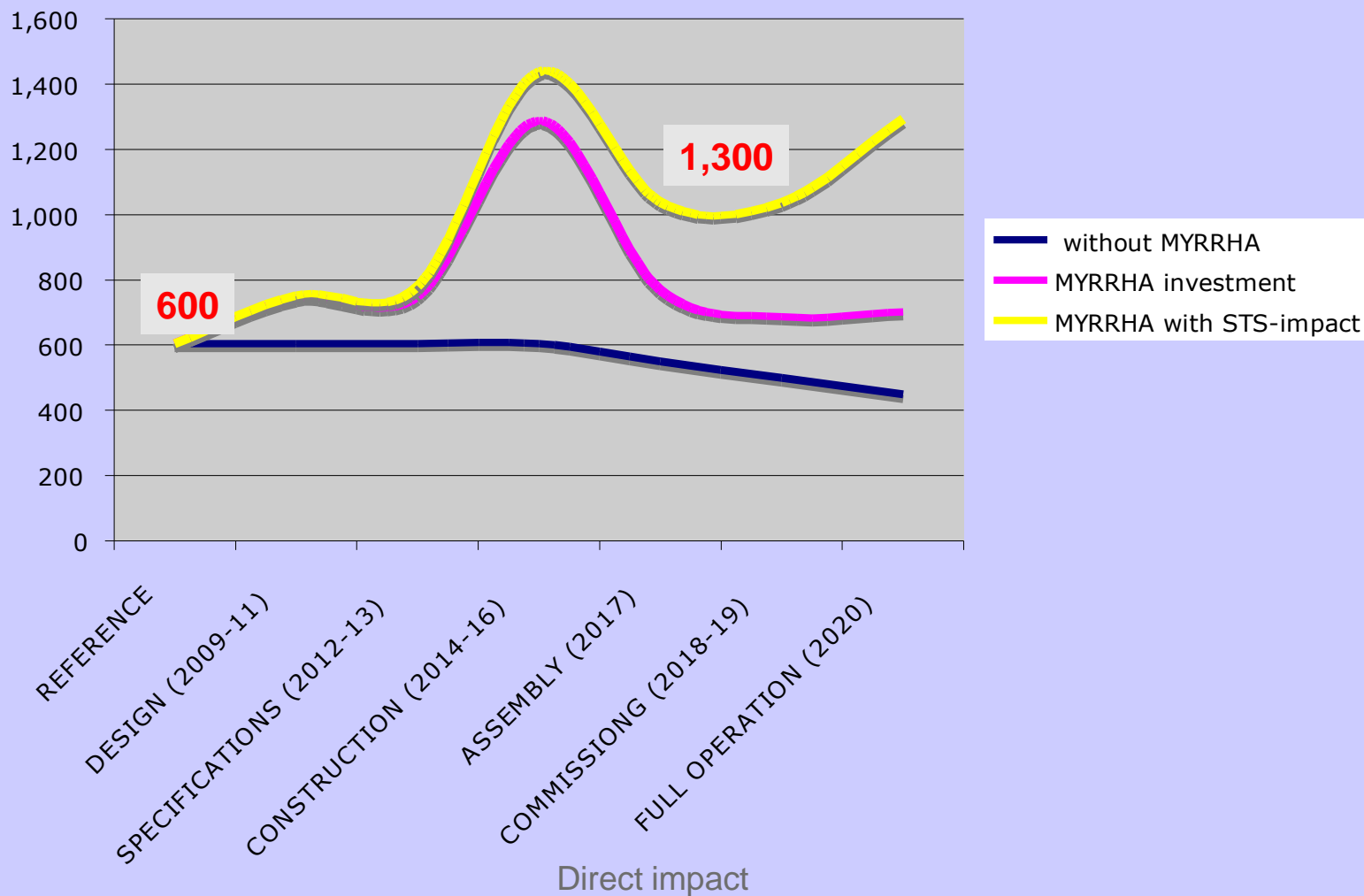


SCK • CEN Funding Sources (proposed)

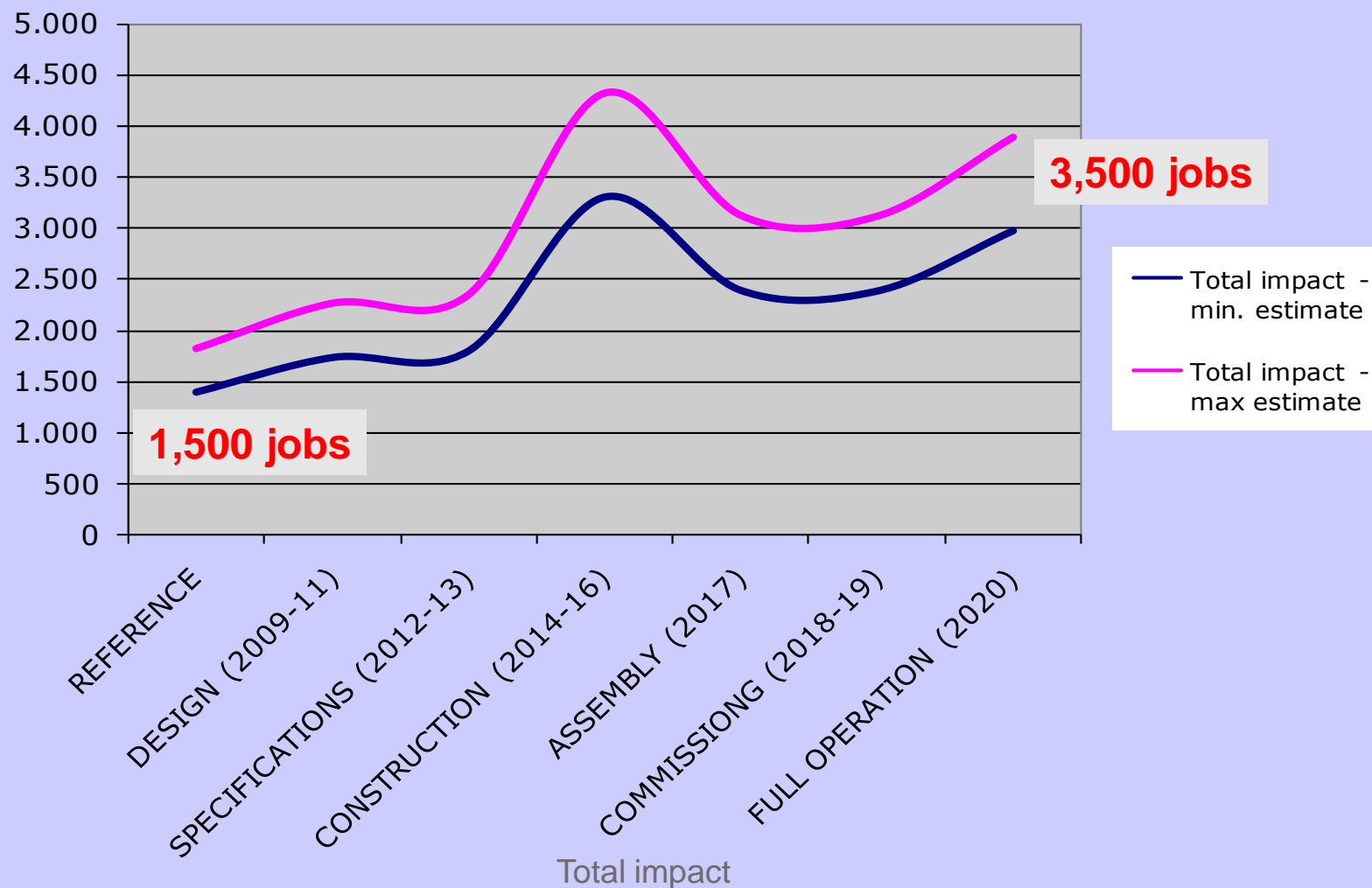


TOTAL OPERATING COSTS**61.2 M€/yr****COSTS OF OPERATION****42.5 M€/yr****COSTS OF EXPERIMENTS****4.1 M€/yr****COSTS OF ORGANISATION'S
REINFORCEMENT****14.6 M€/yr****LOANS' REPAYMENT****(to be defined)****REVENUES****61.2 M€/yr****OWNERS CONSORTIUM
ENDOWMENTS****25.2 M€/yr****+ PROVISIONS FOR LOANS' REPAYMENT
(to be defined)****SCIENCE & TECHNOLOGY
REVENUES****17.1 M€/yr****SERVICES
REVENUES****> 18.8 M€/yr**

Direct impact of MYRRHA on employment (FTE)



Total impact of MYRRHA on employment (FTE)



2009-2011
Detailed
Engineering
Design

2012-2013
Techn.specs
Call for
Tenders
& Awards

2014-2016
Construction
of components
& Civil Works

2017
Components
assembly
on site

2018-2019
Commissioning



Use part of the MYRRHA proton beam for nuclear physics applications

- 600 MeV, 100-200 μA , D.C. proton beam
 - 2.5-3 mA required for MYRRHA spallation target
 - DC beam needed (how to split off 100 to 200 μA)
 - H_2^- beam and extraction (stripper)
 - Magnetic kicker
 - ✓ speed ?
 - ✓ beam structure
 - ✓ **Normal conducting Deflecting RF cavity + septum**
 - ✓ **Drift length required**
 - ✓ **200 μs gaps at 1 Hz already foreseen → move to 250 Hz**
- ⇒ In principle feasible, details to be investigated (FP7)

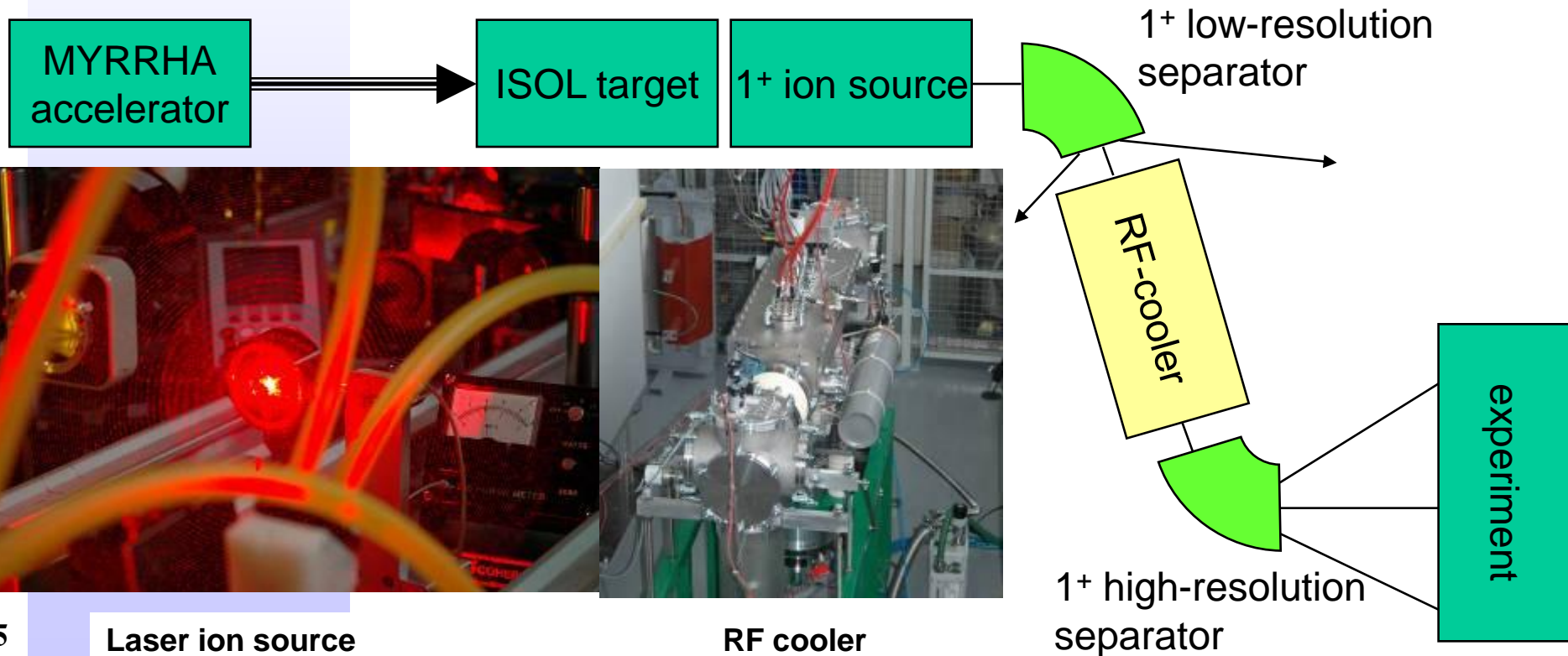
- Targets

- “workhorse” type including U
- e.g. Nb, TiC/C, La, Ta, UC:

- Ion sources

- Ruggedized target-ion source systems that deliver RIB @ ~50 keV:
 - ✓ ECR 1+: gaseous elements (noble gases, C, N, O,...)
 - ✓ surface ion source (hot cavity):
 - ↳ for beam of alkaline and earth alkaline elements
 - ✓ Resonant Ionisation Laser Ion Source
 - ↳ needed to expand the number of applications possible

- “Green field” facility at a nuclear site (SCK•CEN):
 - optimal lay-out of the facility: pre-separator – RF-cooler – post-separator (high mass resolution: $M/\Delta M > 10000$)
 - multiple – ion beams simultaneously : limited mass range for same element
 - specific experimental hall requirements (e.g. neutron detection hall)



- ISOL@MYRRHA can deliver
 - pure RIB: selective ionization, chemistry, $M/\Delta M > 10.000$
 - intense RIB x100 compared to the present ISOLDE
 - ✓ limited number of isotopes at start-up
 - ✓ leave other options open
 - RIB of good ion optical quality
 - very long beam times
 - optimal experimental conditions/lay-out/support
 - **PHYSICS cases**
- ISOL@MYRRHA is based on proven technology
- Complementary to ISOL and In-Flight facilities:
 - HIE-ISOLDE, CERN (Switzerland)
 - SPIRAL2, GANIL (France)
 - TRIUMF (Canada)
 - ORNL (U.S.A.)
 - EURISOL (somewhere in Europe)

- ISOL@MYRRHA is an integral part of the MYRRHA project
 - Delivery of the proton beam to target by MYRRHA
- Target head and separator
 - operated by ISOL@MYRRHA consortium
 - SCK•CEN can/will not do this on its own
 - SCK•CEN will play a significant (frontline) role in ISOL@MYRRHA consortium
- Physics experiment (from focal plane of separator)
 - To be run by users
 - Support by ISOL@MYRRHA in house group @ SCK•CEN

• Workplan – roadmap (close contact between possible users and the MYRRHA team):

➤ **Approval and initial funding of the MYRRHA project**

➤ Preliminary report (IAP)

- physics cases : look what will (is planned to be) done by 2020.
- technical specifications from the users point of view
- budgetplan/estimate

➤ Establishing a users group (including users outside of nuclear physics)

➤ Gathering ISOL expertise at SCK•CEN

➤ Operational model

➤ Time line

• Further applications for the full 4 mA beam (neutron factory)?